Identification and Significance of Innovation
An inverted three junction current-matched two-terminal tandem-cell type MIM could increase current TPV system efficiency by 50% through more efficient use of the blackbody spectrum. In Phase 1 we demonstrated two and three junction (0.74/0.61/0.55eV InGaAs with 2 tunnel junctions) 1x1cm tandem InGaAs proof-of-concept cells on N+ wafers which gave ~0.6V Voc, almost equal to the sum of the InP-filtered 0.74 and 0.61eV subcells. The 0.55eV third junction did not contribute significantly. In Phase 2 we will further develop this subcell and the overall tandem and make MIM type modules on semi-insulating wafers.

Expected TRL Range at the end of Contract (1-9): 4

Technical Objectives and Work Plan (all Phase 1 tasks completed)
• Design two and three junction tandem epistuctures ✓

• Epitaxially grow (MOCVD) wafers for each single junction subcell and tunnel junction in tandems as well as two and three junction tandems ✓

• Design photomasks and fabrication process ✓

• Fabricate 1cm x 1cm test cells on wafers ✓

• Measure illuminated IVs and QEs for test cells ✓

• Dice tandem wafers; package10 die; test under 930C BB ✓

NASA and Non-NASA Applications
NASA: Up to 50% more power for radioisotope GPHS space missions compared with present TPV systems

Non-NASA: This type of InGaAs multijunction stack could be used with terrestrial concentrator solar cells to increase efficiency from 41% to 45% or more.

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